Carlos Ribeiro Justiniano das Chagas in his laboratory at the Federal Serotherapy Institute in Manguinhos, Rio de Janeiro. The Brazilian hygienist, scientist and bacteriologist identified the protozoan parasite *T. cruzi* as the causative agent of Chagas disease.

Videos bons
https://www.youtube.com/watch?v=4ILoy9Hdgqs
https://www.youtube.com/watch?v=9nkysMzPWzQ

https://www.youtube.com/watch?v=jo7e95WyGDE

Carlos Chagas wearing the academic gown of professor of the Tropical Medicine Chair of the Rio de Janeiro Faculty of Medicine. May 23rd. 1925.


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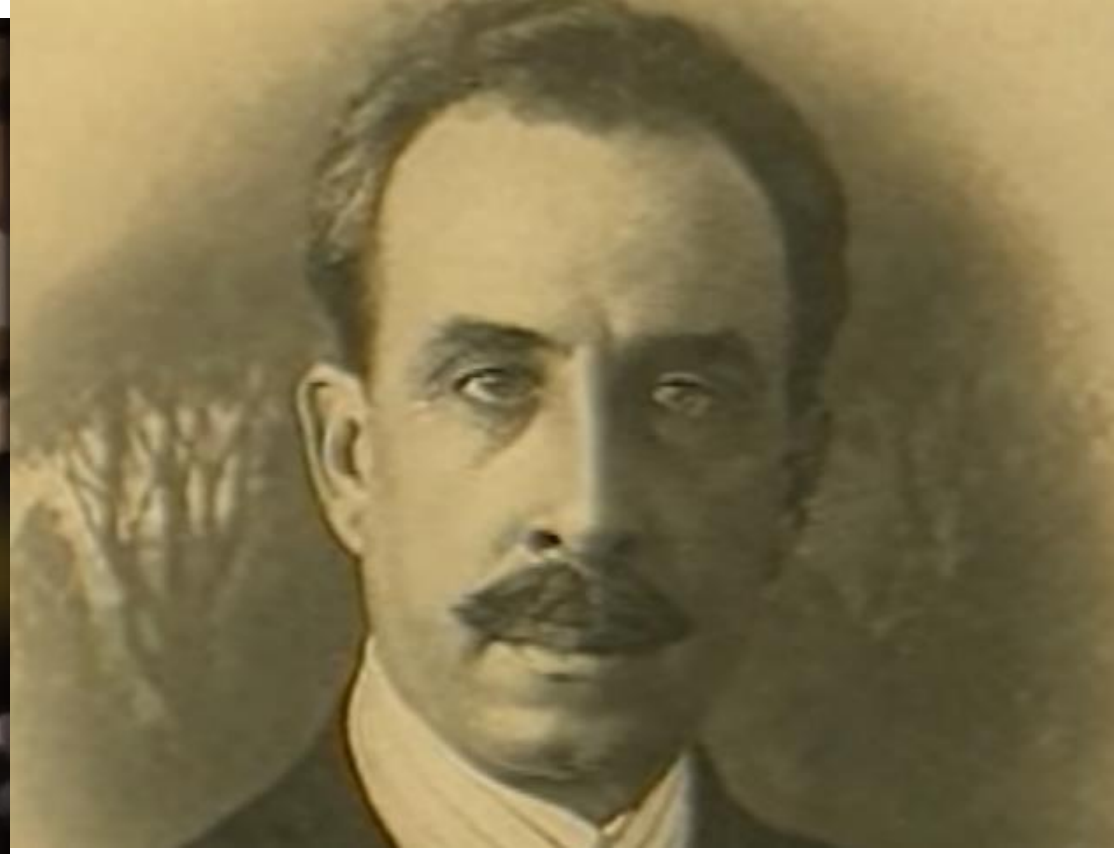
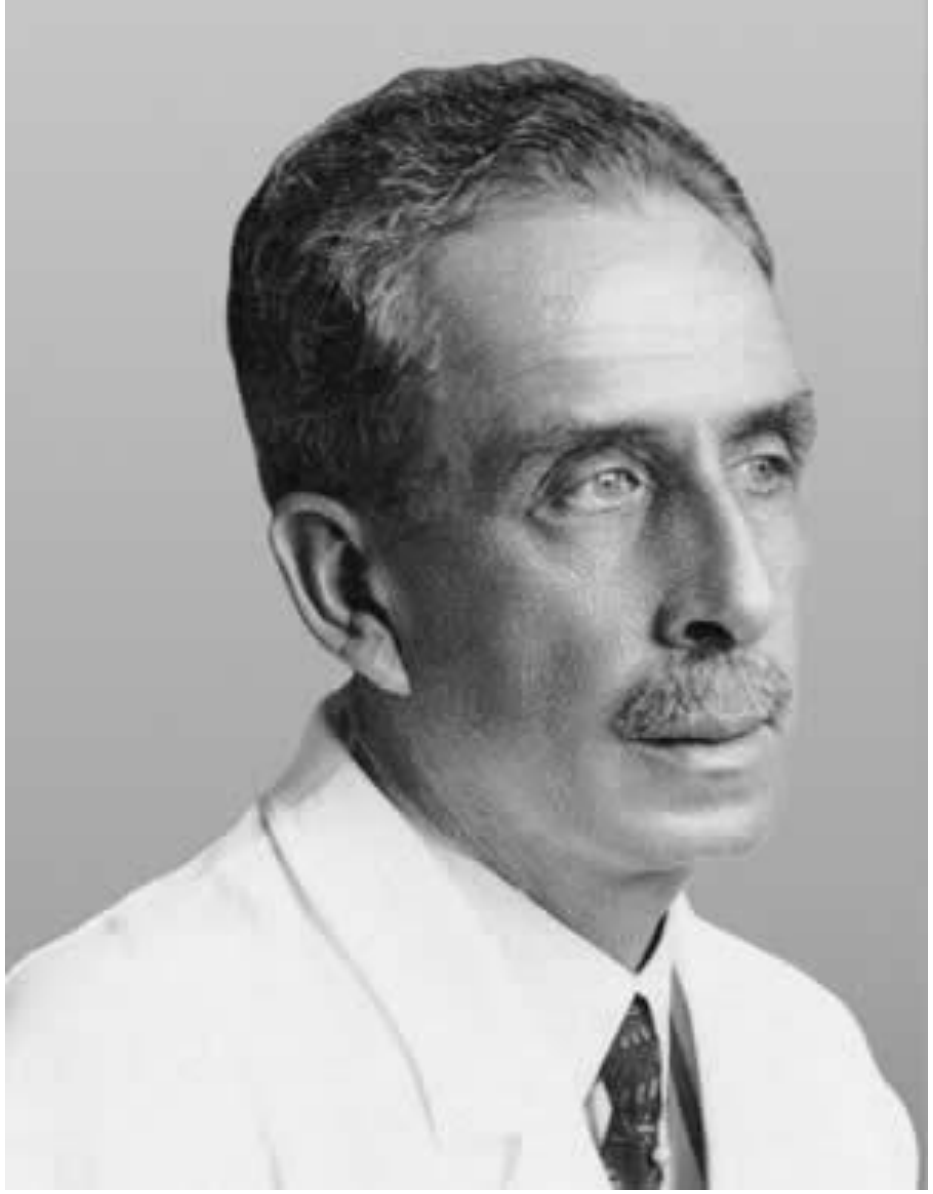
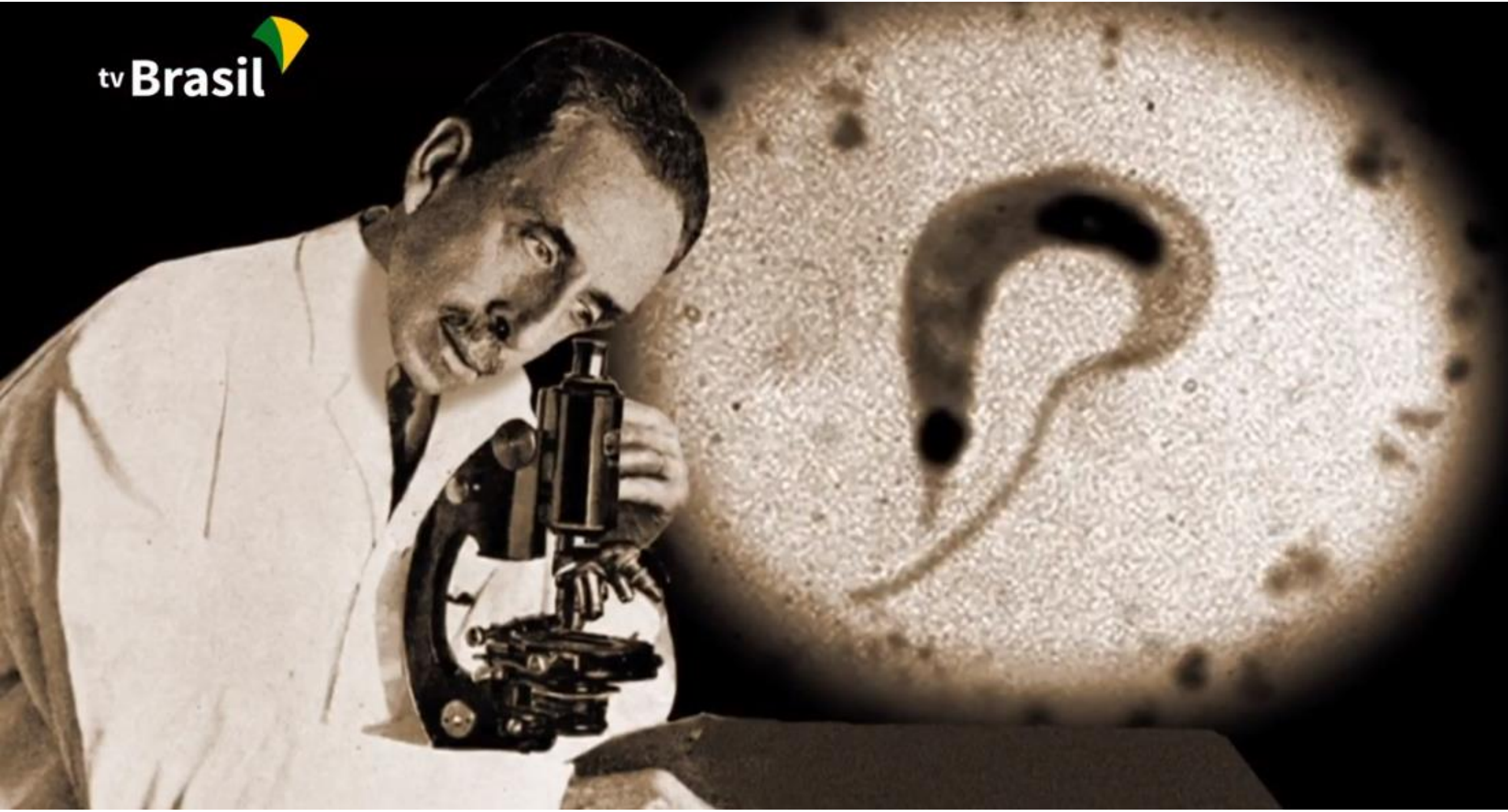




Carlos Chagas, in 1910, in Brazil acquired for the *Instituto de Maguinhos* in Rio de Janeiro, the first electrocardiograph. In the same year, Duque Estrada was sent to France to study radiology and there he bought two devices of the string galvanometer type. One of them was assembled at the old hospital of *Praia Vermelha*, presently the Rector's Office of the Universidade Federal do Rio de Janeiro, in the Service of Juliano Moreira, where Zacheu Esmeraldo, a psychiatrist in 1912, prepared his thesis on "Atrial Fibrillation".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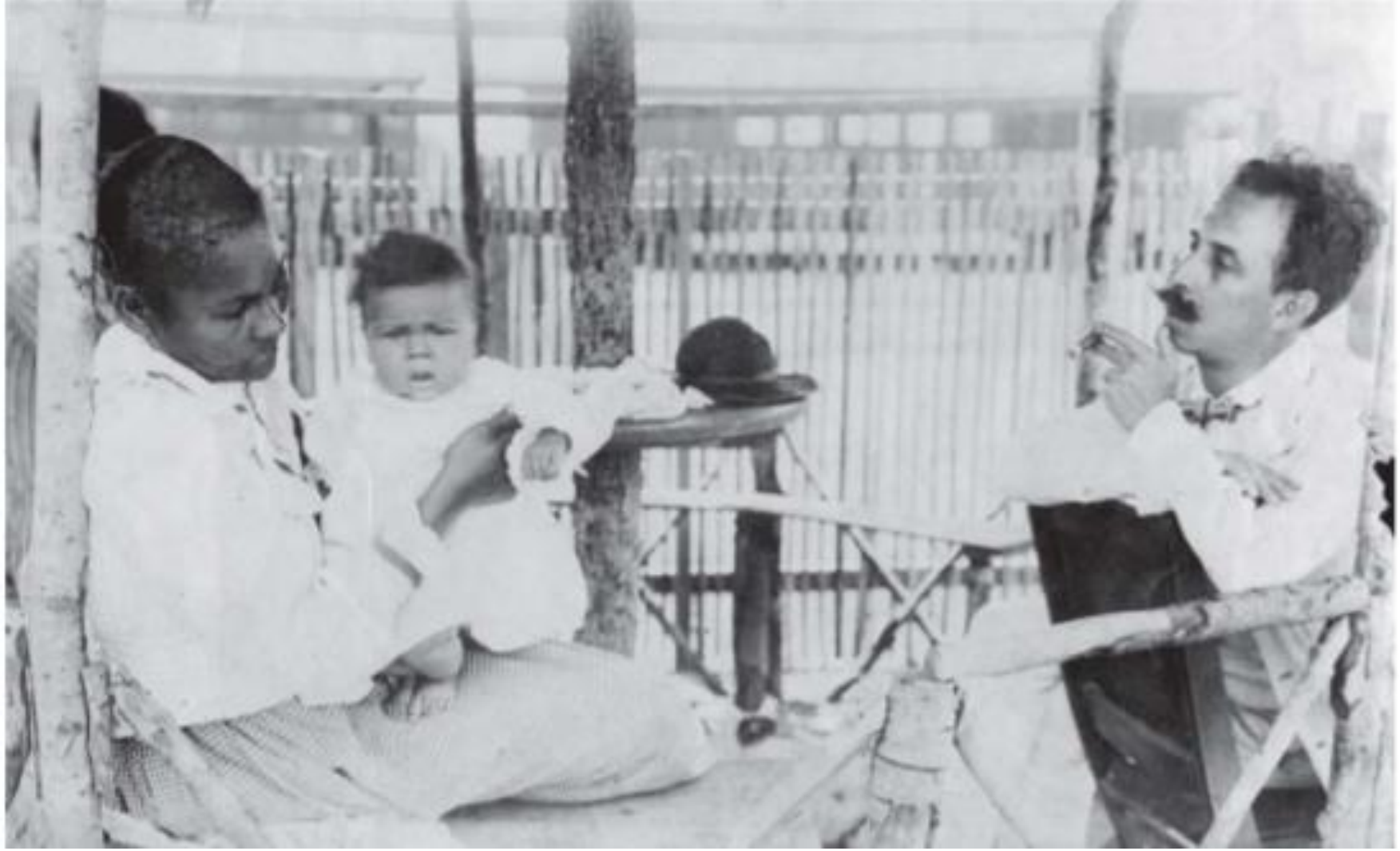
Carlos Chagas, Belisário Penna (ao seu lado esquerdo) e outros membros da turma de estudos do prolongamento da Estrada de Ferro Central do Brasil, em ao prédio da ferrovia. Minas Gerais, [1907]

Carlos Chagas com seu filho Carlos 1914

Carlos Chagas com Raul Leitão da Cunha, entre outros, durante solenidade em homenagem a Ethel Parsons, da Fundação Rockefeller, encarregada, junto ao governo brasileiro, de implantar o curso de formação de enfermeiras no Brasil. Provavelmente o evento ocorreu na residência da Avenida Rui Barbosa, local de hospedagem das alunas do curso de enfermagem. 29 jul. 1926.



Carlos Chagas observa a menina Rita, um dos primeiros casos da doença de Chagas. Lassance, 1908. No livro sobre o pai, Carlos Chagas Filho comenta sobre essa imagem: “Carlos Chagas atendendo Rita, um dos primeiros casos da doença de Chagas descrito em artigo das Memórias do Instituto Oswaldo Cruz, em 1916. A garotinha, por muito tempo identificada como Berenice, morreu três dias após a consulta. Ao fundo, percebe-se o vagão que lhe servia de dormitório e laboratório, em Lassance”. Berenice, uma criança em 1909, foi o primeiro caso descrito de doença de Chagas. Por muito tempo, Rita foi confundida com Berenice, e essa imagem usada como a representação do primeiro caso descrito da doença em humanos. Os elementos secundários da imagem – o vagão, misto de dormitório e laboratório, e o local de atendimento, uma espécie de caramanchão – fortalecem a impressão da precariedade de condições dos primeiro tempos

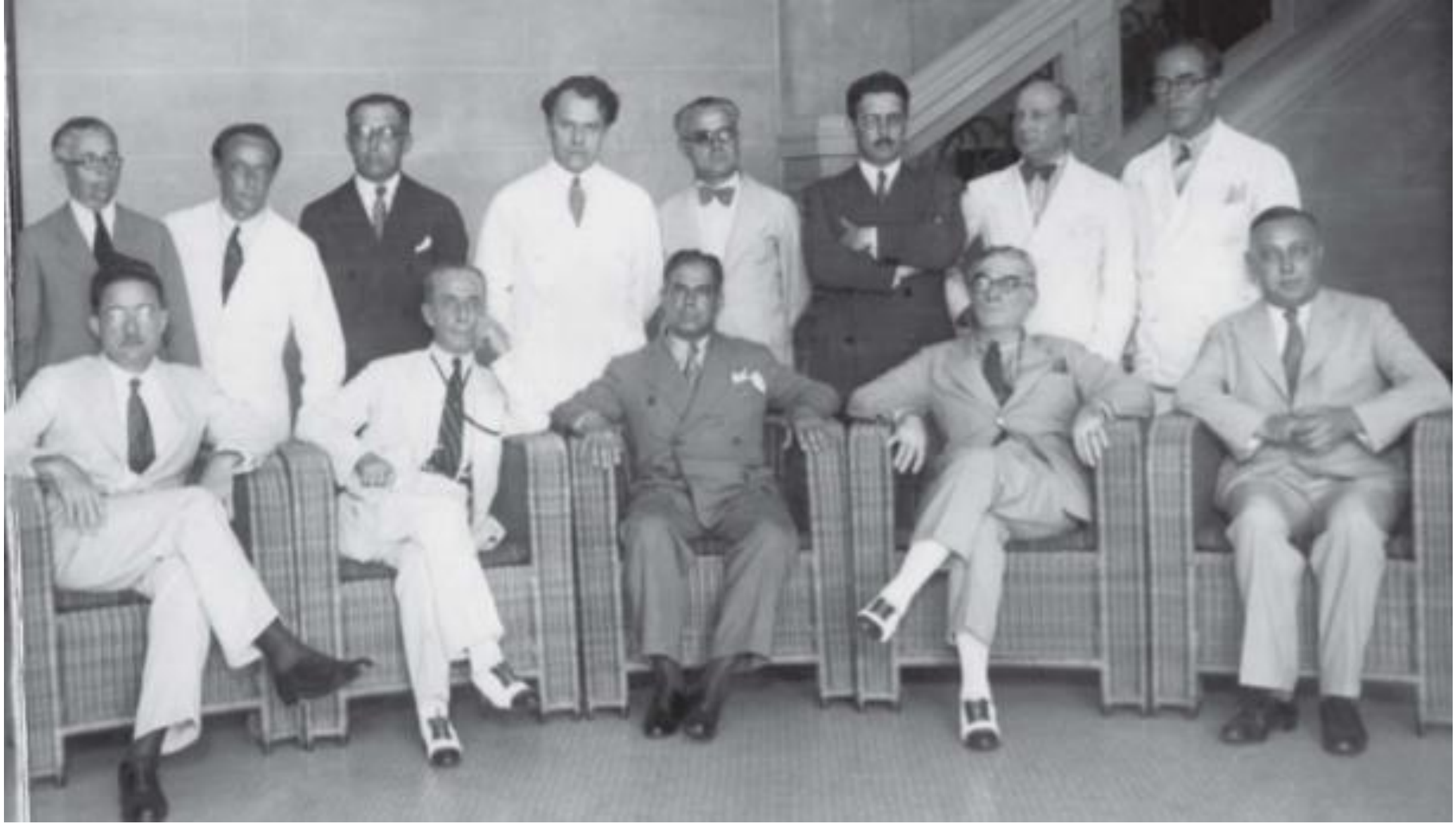
Carlos Chagas com sua neta Tatiana, filha de Evandro Chagas. [1930?]

Foto 5: Carlos Chagas numa das varandas do castelo de Manguinhos, com os filhos Evandro (à direita) e Carlos (à esquerda). [191-]. (Foto J. Pinto)

Foto 5: Carlos Chagas numa das varandas do castelo de Manguinhos, com os filhos Evandro (à direita) e Carlos (à esquerda). [191-]. (Foto J. Pinto)

In the image, Carlos Chagas (in the highlight, in yellow), receives the physicist Albert Einstein at the Instituto Oswaldo Cruz

Carlos Chagas recebe a visita do cientista Albert Einstein nas instalações do Instituto Oswaldo Cruz na presença de pesquisadores como Alcides Godoy, Astrogildo Machado, Carneiro Felippe e Leocádio Chaves. 9 maio 1925.



Da esquerda, sentados, Carlos Chagas (o segundo) reunido com Fred Lower Soper (responsável a partir de 1930 pelas ações da Fundação Rockefeller nas campanhas de combate à febre amarela no país – o primeiro), Raul de Almeida Magalhães (o quarto). De pé, Mário Pinotti (o quarto), entre outros. As razões do encontro não foram identificadas. [entre 1930 e 1934]

Aspecto de uma habitação típica da região estudada por Chagas e de membros de uma família. Percebem-se sinais de bócio, considerado pelo cientista, em seus primeiros trabalhos, um sinal clínico típico da nova tripanossomíase (hipótese mais tarde descartada)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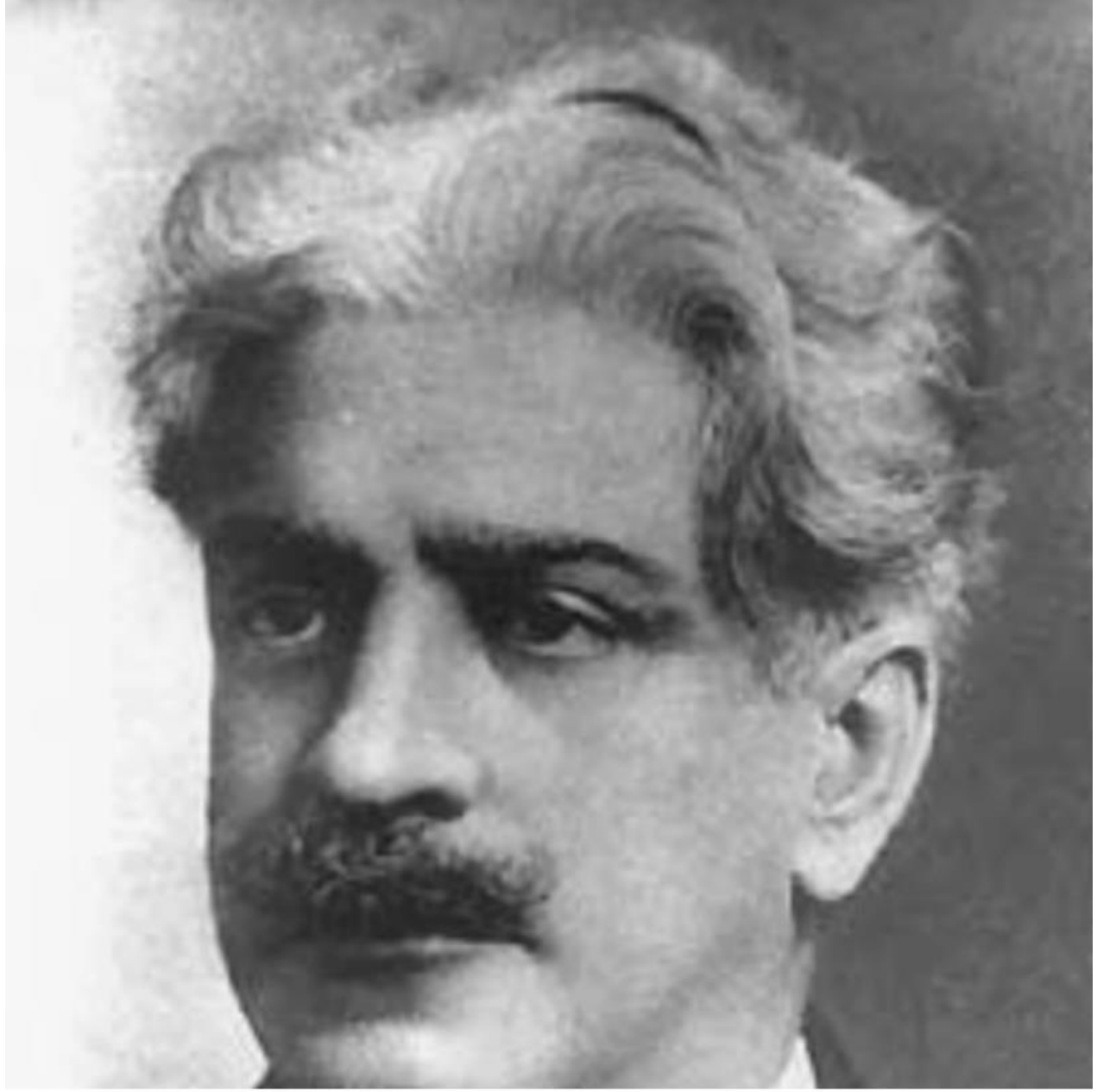
ADULTO
NINFAS

Barbeiro do açai



Oswaldo Gonçalves Cruz. The Brazilian physician, bacteriologist and epidemiologist was the mentor of Carlos Chagas who discovered American trypanosomiasis. Cruz founded in 1900 the Federal Serotherapy Institute which was renamed in 1905 to Manguinhos Experimental Pathology Institute, then in 1908 to Oswaldo Cruz Institute and finally in 1974 to Oswaldo Cruz Foundation (Fundação Oswaldo Cruz (Fiocruz)).


Oswaldo Cruz

Carlos Chagas: Biographical sketch Álvaro Moncayo∗ National Academy of Medicine, Carrera 7 No. 69-11, Bogotá DC, Colombia,

Carlos Chagas was born on 9 July 1878 in the farm "Bon Retiro" located close to the City of Oliveira in the interior of the State of Minas Gerais, Brazil. He started his medical studies in 1897 at the School of Medicine of Rio de Janeiro. In the late XIX century, the works by Louis Pasteur and Robert Koch induced a change in the medical paradigm with emphasis in experimental demonstrations of the causal link between microbes and disease. During the same years in Germany appeared the pathological concept of disease, linking organic lesions with symptoms. All these innovations were adopted by the reforms of the medical schools in Brazil and influenced the scientific formation of Chagas. Chagas completed his medical studies between 1897 and 1903 and his examinations during these years were always ranked with high grades. Oswaldo Cruz accepted Chagas as a doctoral candidate and directed his thesis on "Hematological studies of Malaria" which was received with honors by the examiners. In 1903 the director appointed Chagas as research assistant at the Institute. In those years, the Institute of Manguinhos, under the direction of Oswaldo Cruz, initiated a process of institutional growth and gathered a distinguished group of Brazilian and foreign scientists. In 1907, he was requested to investigate and control a malaria outbreak in Lassance, Minas Gerais. In this moment Chagas could not have imagined that this field research was the beginning of one of the most notable medical discoveries. Chagas was, at the age of 28, a Research Assistant at the Institute of Manguinhos and was studying a new flagellate parasite isolated from triatomine insects captured in the State of Minas Gerais. Chagas made his discoveries in this order: first the causal agent, then the vector and finally the human cases. These notable discoveries were carried out by Chagas in twenty months. At the age of 33 Chagas had completed his discoveries and published the scientific articles that gave him world recognition and a deserved high place in medical history. After the publication of his classic article the world paid homage to Chagas who was elected member of the National Academy of Medicine of Brazil on 26 October 1910, and at the age of 31, of other National Academies of the continent. The Committee of Hygiene of the Society of Nations, precursor of the World Health Organization, was created in 1929. Chagas was elected member of

this Committee from its inception until 1933. The example of Chagas' life can be summarized in his interest that medical research should be translated into concrete benefits for human beings because he was convinced that disease had not only biological but social determinants as well. Carlos Chagas was a laboratory researcher, a clinician and a health administrator. For all these accomplishments he deserves our respect and admiration. The farm “Bon Retiro” where Carlos Chagas was born on 9 July 1878 was located some 20 km from the City of Oliveira in the interior of the State of Minas Gerais, Brazil. The family was well off, with high social standing and owned this farm for three generations.

Carlos Chagas was the first of four sons and his father died leaving the mother in charge of the farm and in care of the young family. Since his infancy Chagas was raised in the simple country life without social barriers with other children in the neighborhood.

His secondary studies were completed in a religious high school, Colegio Sao Francisco, in San Juan del Rey, a city of the same state. Here, Carlos Chagas started his interest in biology through the observation of nature under the guidance of one of his teachers, Father Joao Batista do Sacramento, a liberal priest who also initiated Chagas in the reading of the classics and Brazilian literary authors. At the end of his secondary studies, his mother wanted him to study engineering and he started professional studies in this field at the School of Engineering in Ouro Preto, founded by the Emperor Dom Pedro II, where Chagas remained for few months. Only after long family discussions, the mother accepted that Chagas studied medicine and he was registered as a student in 1897 at the School of Medicine of Rio de Janeiro, recently reformed by the Viscount of Saboya (Chagas Filho, 1993a). The medical teaching followed the French anatomical model and the clinical examination of patients was based on Laennec’s semiology and on a detailed anamnesis. In the late XIX century, the works by Louis Pasteur and Robert Koch induced a change in the medical paradigm with emphasis in experimental demonstrations of the causal link between microbes and disease. During the same years in Germany appeared the pathological concept of disease, linking organic lesions with symptoms, and the discoveries of Paul Ehrlich in the chemical synthesis of therapeutic compounds. All these innovations were adopted by the reforms of themedical schools in Brazil and

influenced the scientific formation of Chagas. Malaria and Yellow Fever were prevalent in Brazil in those years, especially during the summer, in Rio de Janeiro, the capital of the empire. Hematozoan parasites were known to be the causative agents of Malaria but the cause of Yellow Fever and its mode of transmission were not. Chagas was interested in the analysis of the vomits and stools of the patients in search of an experimental demonstration of a causative microbe. Naturally the viral agent could not be evidenced with the methods available at the time. Chagas met Miguel Cuoto at the Hospital “Santa Casa” where the medical students had their clinical practice. Cuoto introduced Chagas to the detailed study of the experimental works published by Claude Bernard and Louis Pasteur. He also met Francisco Fajardo who appointed him as his laboratory assistant in his studies on the hematozoan parasites, the causative agents of human malaria. This laboratory experience with Fajardo would prove very useful in the doctoral work that Chagas was to start in 1902 at the Institute of Manguinhos under the guidance of Oswaldo Cruz.

Chagas completed his medical studies between 1897 and 1903 and his examinations during these years were always ranked with high grades. His clinical learning at the bedside of the patients was enhanced by his laboratory experience which oriented his reasoning towards the searching for the causes of disease and the linking of the clinical symptoms with the causal agents and their mode of transmission Oswaldo Cruz accepted Chagas as a doctoral candidate and directed his thesis on “Hematological studies of Malaria” which was completed in 1903 and was received with honors by the examiners. This research was carried out in 45 patients and is an example of detailed knowledge of the morphology, the life cycle of the hematozoan in man and the relationship with the clinical symptoms. For example, the description of the relationship between the increase of parasitaemia and the febrile crises in the patient is an example of precise observation and clarity of language. In 1903 the director appointed Chagas as research assistant at the Institute. However, since the daily clinical practice was so important for Chagas, he succeeded in being appointed as a house doctor at the Hospital of Juruba, an institution of the public health city network that was in charge of the management and treatment of patients with infectious diseases.

In those years, the Institute of Manguinhos, under the direction of Oswaldo Cruz, initiated a process of institutional growth and gathered a distinguished group of Brazilian scientists, namely, Henrique Figuereido de Vasconcellos, Henrique Rocha Lima, Antonio Cardoso Fontes, Alcides Godoy, Arthur Neiva, Carlos Chagas, Henrique Aragao and Ezequiel Dias and of foreign collaborators, among them: Stanislaus von Prowazek (parasitologist), Gustav Giemsa (chemist, inventor of the staining of microscopic preparations), Max Hartman (parasitologist) and Hermann Dürek (pathologist) (Chagas Filho, 1993b). For a young doctor such as Carlos Chagas, this was an exceptional scientific environment to advance his laboratory and field research work in experimental medicine.

In March 1905, Chagas was commissioned to control malaria outbreaks in Itatinga, close to the port of Santos and afterwards in the Xerem valley. In both opportunities he put into practice, with success, the intradomicile spraying with insecticides to prevent the contact of the mosquito with man. In 1907, he was requested again to investigate and control another malaria outbreak, this time in Lassance, Minas Gerais. In this moment Chagas could not have imagined that this field research was the beginning of one of the most notable medical discoveries. When reading his reports, written in a clear and elegant style, the reader realizes that the observations and precise conclusions are the fruit of lucid reasoning (Brener, 1989). Chagas was, at the age of 28, a Research Assistant at the Institute of Manguinhos and was studying in a Callitrix penicillata primate a new flagellate parasite isolated from triatomine insects captured in the State of Minas Gerais. He described and named this parasite Trypanosoma minasense. During the field work in Lassance, Cantarino Motta, the chief engineer of the construction works of the central railroad of Brazil, showed Chagas an insect that hid in the cracks of the mud walls of the rural dwellings whose inhabitants complained that at night they were bitten in the face by these insects, known locally as “barbeiros” (“barbers”). He also observed that a clinical condition in that region was frequent in children. The clinical picture was characteristic with episodic fever, severe anemia, spleen enlargement, edema and swollen lymph nodes. Most cases had a benign progression after a few weeks but a proportion of them developed severe cardiac lesions.

The complete description of the clinical picture was made in a two-year-old girl, Berenice, from whose blood Chagas isolated the same parasites that he inoculated in laboratory animals in which he described the different phases of the life cycle of the parasite. The scientific question for him to ask was whether the clinical picture observed in men was caused by the parasite isolated in the insects. The only way to prove it was through experimentation: the first step was to show that the parasite could also infect other mammals. Chagas sent some insects to Oswaldo Cruz requesting him to inject their intestinal contents in laboratory bred monkeys that were free of natural infections. A few weeks later he received a communication from Cruz reporting that one of the experimentally infected monkeys was sick. Chagas returned to the Institute and observed in the monkey blood the same parasites that he had observed in the bloodstream of the patients in Lassance. This time he named the parasite Trypanosoma cruzi in honor of Doctor Cruz. The cardiac alterations, the most serious chronic lesions of the disease, had also been observed by Chagas who describe them as follows: “The symptoms that most deeply impressed me in the patients of that region, particularly in those that lived in houses infected by the triatomine insects, were the cardiac rhythm alterations in the form of extra systoles”

The link between the causal agent, the vector and the clinical picture was complete!

Chagas made his discoveries in this order: first the causal agent, then the vector and finally the human cases. The little girl Berenice was the first patient in whom was described and experimentally confirmed the medical entity that later on was to be named “Chagas disease”. These notable discoveries were carried out by Chagas in twenty months, living in a car of the central Brazilian railroad where he had installed his house and his field laboratory in Lassance. If we compare the time elapsed to confirm the aetiology, the transmission and the symptoms of other tropical diseases, the work of Carlos Chagas is outstanding. For example, the correct description of the life cycle and the symptoms of schistosomiasis took sixty years from when Theodore Bilharz studied the helminthes and their eggs in 1852 until the whole process was described in 1915.

Likewise, Leishman and Donovan described the causative parasite of leishmaniasis in 1900, but the vector was identified twenty six years later and the mode of transmission was described only in 1940 (Coutinho et al., 1999). At the age of 33 Chagas had completed his discoveries and published the scientific articles that gave him world recognition and a deserved high place in medical history (Chagas, 1909). In 1910, in a conference that he delivered at the National Academy of Medicine, Chagas summarized his research work, as follows: “As you can see the study of this disease shows the curious fact that we started with the detailed knowledge of the biology of the causal agent to arrive later at the demonstration of its role in the aetiology of a human disease. On the contrary, in the aetiological discovery of other diseases the starting point is the description of the clinical symptoms and the epidemiological circumstances and from there we arrive at the isolation of the suspected causal microbe” (Chagas, 1910). After the publication of his classic article the world paid homage to Chagas who was elected Member of the National Academy of Medicine of Brazil on 26 October 1910, at the age of 31, and of other National Academies of the continent such as Colombia, where he was elected Corresponding Member at the session of 27 September 1918 (Academia Nacional de Medicina, 1918). In 1912 he received the prestigious Schaudinn Prize that the Institute of Tropical Diseases of Hamburg granted every four years to the world’s most important contribution in parasitology. Chagas won this Prize in competition with other candidates of high merits such as Laveran, Leishman, Roux and Ehrlich. The controversy on the existence of Chagas disease was initiated by Rudolf Kraus, Director of the Institute of Bacteriology of Buenos Aires, who published several reports in which he expressed his doubts with the argument that he had studied the presence of infected triatomines in the sub tropical regions of Northern Argentina but that human cases of the disease had not been reported. Chagas attended the Congress ofMedicine in Buenos Aires in 1916 and made his presentation in which he contested these arguments by saying that it was understandable that the local doctors could not report human cases of the disease since they had never suspected it. Some years later, the controversial issue was resolved when the Argentinean doctors Salvador Mazza and Cecilio Romana, demonstrated the existence of cases of

Chagas disease in ˜ rural areas of the Northern Provinces of Argentina The “Spanish flu” decimated the city of Rio de Janeiro in September 1918. Carlos Chagas was requested to organize the emergency hospitals and the health centers network of the city to treat the numerous patients of this outbreak. Chagas called upon the medical practitioners and the students of medicine to face the situation and showed his skills as a health administrator. His successful work in this respect was publicly recognized by the Federal Senate. In 1917 Oswaldo Cruz died and Chagas was appointed Director the Institute of Manguinhos at the age of 38. The candidate to replace Cruz was the Acting Director Henrique Figuereido de Vasconcellos who never forgave the selection of Chagas as Director. The new director obtained additional federal budget and started a phase of institutional growth including the construction and equipment of laboratories and facilities. One of these visionary projects was the construction of an industrial plant for the production of quinine for distribution in the malaria control programs in the country. This facility was the origin of the present FARMANGUINHOS, the modern high tech production branch of drugs and vaccines at low prices for use in public health programs in Brazil. These new projects and the appointments that Chagas made created an atmosphere of tension within the Institute that materialized in a belligerent group allied against the Director and was the responsible for the challenge of his discoveries that emerged this time in Brazil, between 1922 and 1924. Another source of hostility was the role played by Chagas when he was appointed by the Federal Government as Director of the Department of Public Health. Doctor Afranio Peixoto, a powerful member of the medical establishment of Rio de Janeiro, wanted the post and was very disappointed when he was not selected. The attacks against the scientific work of Carlos Chagas were most noisy in what was known as “the debate of the Academy” in 1922 when Peixoto openly challenged the discovery and disputed that any aetiological link existed between the parasite and the clinical picture. In addition, he claimed that the frequency of the new disease had been overestimated (Chagas Filho, 1993c). These accusations were unfounded and did not have any experimental nor epidemiological basis. Chagas requested the appointment of a Commission from the Academy for the study of his research work and in particular for the clarification of the gratuitous accusation from Figuereido de

Vasconcellos that the discovery of T. cruzi had been made by Oswaldo Cruz and not by Chagas. The Commission, after completion of its task that included field visits to the endemic areas, delivered a favorable report confirming the transparency of Chagas' work. This unfortunate controversy about his discoveries influenced the Nobel Committee who did not retain his name for the Prize of Physiology and Medicine in 1921 when he was proposed by H. de Gouvéa at the request of the Committee (Coutinho et al., 1999). The Committee of Hygiene of the Society of Nations, precursor of the World Health Organization, was created in 1929. Chagas was elected member of this Committee from its inception until 1933. The Committee met annually in Paris and Chagas visited scientific European institutes where he presented his research works. During those years Chagas was decorated by the Governments of Belgium, France, Italy, Spain and Rumania. From 1926 until his death in 1934, Chagas held the chair of Tropical Medicine at the School of Medicine of Rio de Janeiro. He presented his lessons, examples of clarity and sound knowledge, at the "Pavilhao", an amphitheater in the Hospital Sao Francisco where he discussed clinical cases and laboratory results of the patients. Chagas was active in teaching and in the direction of the Institute of Manguinhos until his death on November 8, 1934. The example of Chagas' life can be summarized in his interest that medical research should be translated into concrete benefits for human beings because he was convinced that disease had not only biological but social determinants as well. Carlos Chagas was a laboratory researcher, a clinician and a health administrator. For all these accomplishments he deserves our respect and admiration. In the above mentioned conference before the National Academy of Medicine in 1910, he said: "Could we find public health procedures to alleviate this situation? I am convinced that this is a humane and also a state problem and that the scientifically well oriented statesman who launches such a public program with successful results, will win the recognition of my compatriots and the future generations of Minas Gerais" (Chagas, 1910). This fervent desire, so eloquently expressed by Carlos Chagas in 1910, was accomplished in his own country in 2006 when Brazil was certified free of vectorial transmission by Triatoma infestans by an International Commission convened by the Pan American Health Organization (Pan American Health Organization, 2006, World Health

Organization, 2007). Likewise, the interruption of transmission by T. infestans was also certified in Uruguay in 1997 and in Chile in 1999 (World Health Organization, 2002).

Between November 1922, and December 1923, the Brazilian National Academy of Medicine was the stage of a great controversy regarding Chagas disease. A group of doctors (among which were Afrânio Peixoto, a professor of Hygiene in the Medical University of Rio de Janeiro; Henrique Figueiredo de Vasconcellos, researcher of the Oswaldo Cruz Institute; and Parreiras Horta, professor of Parasitology in the Agriculture and Veterinary Medicine School) contested the authorship of the discovery of *T. cruzi*, accused the American trypanosomiasis of having been made up and questioned the importance it had been attributed to by the government, claiming that there was no evidence of the disease extending beyond the boundaries of Lassance. After examining the claim, a committee of the Academy identified Chagas as indeed the true discoverer, but couldn't respond as to the distribution of the disease in the country. The problem was once and for all solved in the 1930s. The research of Argentinean doctors Salvador Mazza and Cecilio Romaña, detected hundreds of acute cases in Argentina and proved the disease was not restricted to Brazil, but it also affected other countries in the continent. At the same time, Brazilian researchers worked hard to prove the ample distribution of the disease. In 1935, Chagas's oldest son, Evandro, created, at the Oswaldo Cruz Institute, the Great Endemic Diseases Study Service, thus stimulating research on the disease. In 1940, researcher Amilcar Vianna Martins described 25 acute cases of Chagas disease in the city of Bambuí, in the Brazilian state of Minas Gerais. In 1943, the Oswaldo Cruz Institute built a research center in Bambuí, conducted by researcher and Carlos Chagas's collaborator, Emmanuel Dias. The center was renamed the Emmanuel Dias Advanced Research Station in 1980, which is considered a landmark for the assertion of Chagas disease as a relevant public health issue for both Brazil and Latin America. In 1959, the 1st International Congress on Chagas Disease, carried out in Rio de Janeiro, made it evident that the disease had finally been recognized as socially important and that the scientific trail picked up by Carlos Chagas should be followed and explored in search of new paths and solutions.

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